Is there any significant difference in global volatility of and correlation between shari'ah-compliant (Islamic) equities and sukuk ?

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Is there any significant difference in global volatility of and correlation between shari'ah-compliant (Islamic) equities and sukuk ?

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Abstract

Islamic finance is still both a nascent and niche market globally. That its products "mimic" their conventional counterparts is a constant cry of criticism often heard spoken among financial professionals. That financial products are developed and marketed in the global capital markets is axiomatic. Equally clear is the fact that equities and fixed-income securities form the two predominant pillars of the global capital markets. While there exist numerous studies of the covariances between equity and bond asset classes, the field is significantly narrowed as to those that apply the more recent financial techniques for measuring volatilities and correlations. There presently exist a veritable dearth of research as to whether Shari'ah-compliant equities and sukuk (a proxy for fixed-income or debt securities) have covariances and correlations similar to or different from those of their conventional counterparts. The level of inquiry should increase as more data presently exists on these Islamic asset classes and Islamic finance continues to gain ground in the global capital market. This study is a preliminary step towards answering the open question of the similarities and/or dissimilarities between the volatility and correlations between these two markets and asset classes. This study finds that there exist significant differences in the volatilities between Shari'ah-compliant equities and sukuk. It further finds that those differences are amplified by examining the behavior of the two asset classes during the recent 2007-2008 financial crisis. Moreover, it finds that the correlative behavior, in general, of these Islamic asset classes is not significantly different from that of their conventional counterparts.

Keywords: Shariah-compliant (Islamic) equities, Sukuk, MGARCH, Wavelets

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1.0 INTRODUCTION

Conventional financial economic wisdom posits that financial asset variances (hereinafter including covariances and cross-variances unless otherwise specified) and correlations (scaling of the covariances by variable standard deviations) are time variant and persistently dynamic. They are time variant because they change over various time periods and are not static; and persistently dynamic because returns differ over time as to both size (large/small) and direction (positive/negative). Variances are key determinants of volatility in financial markets. Volatilities and correlations are central to asset price discovery, risk measurement and portfolio management (Anderson, 2007). Conditional variances (i.e. forecasted variances) because of their prospective nature act as harbingers of future capital market variable behavior (De Goeij, 2002). Said differently, volatilities and their correlations arguably represent the single most important statistic in assessing the risk-expected return relationship in capital markets.

The forecasting of conditional covariances in financial markets has grown dramatically since the introduction of Generalized Autogressive Conditional Heteroskedasticity (GARCH), which conditionally forecasts estimates of auto-regressed variances and mean variables based on moving averages of lagged actual past and estimated volatility by accounting for autocorrelation of related error terms. However, GARCH is limited to univariate time invariant data and does not measure covariances. Multivariate GARCH or MGARCH has developed as a more useful tool for measuring volatility in financial markets, which are ostensibly leptokurtic, i.e. having narrower distribution "humps" and broader distribution "tails;" both symptomatic of high frequency volatility and the so-called "leverage effect."

MGARCH measures means and variances in financial data and is an important forecast tool where asymmetry exists in financial markets. Asymmetry occurs when there is imbalance in a financial transaction as to information or "news." In a capital markets context, this is often linked to bad news. When, for example, stock price volatility related to bad "news" causes equity price decreases; thus affecting debt pricing. This has been referred to as the "leverage effect," a term coined by Black to describe the negative correlation between past price returns and future realized volatilities in capital markets (Black, 1976). Financial analysts

work with the leverage effect to estimate default premiums using option-valuation models (Bodie & Kane, 2011, p. 605).

Equity and debt securities comprise the primary broad components of the capital markets globally. Derivatives and foreign exchange instruments (Bacha, 2013) loom as ever growing components, albeit they are contracts referenced to underlying equity, debt, or related rates or index values (Bodie & Kane, 2011, p. 32). While a plethora of research has evolved on conditional variances and volatilities in general, far less research exists on the covariance and correlation of equity and debt securities in the world's capital markets.

That dearth in research is even more pronounced with respect to the application MGARCH and DCC to equity-debt covariance and correlation. Dynamic Conditional Correlation or DCC, first introduced by Robert Engle (Engle, 2002), uses MGARCH to produce a 2-step estimation process by performing a univariate volatility parameter estimation of each variable using GARCH; then using the standardized errors from that process as inputs for estimating time variant multi-variant correlation matrices, i.e. cross-correlations.

1.1 Motivation for Research. Shari'ah-compliant screening of equities (first introduced by Bank Islam as early as the 1980s) and the related indices (Dow Jones Islamic Market Index, viz. being introduced in 1999) and the more recent growth of sukuk (Islamic surrogates for "fixed-income" securities) introduced over a decade ago, now provide both the incentive and "fertile ground" for research into the covariance and correlations between Shari'ah-compliant equities and sukuk. Notwithstanding the impetus, there still exists a veritable dearth of research on the covariance, correlation and cross-correlation of the equities and debt securities in the Islamic financial space.

1.2 Objectives of Research. Accordingly, this paper examines the covariance and correlation relationship between Shari'ah-compliant equity securities and sukuk using broad indices. The question arises whether or not Shari'ah-compliant equity and sukuk securities act similar to their conventional counterparts? It is noteworthy that most of the global Shari'ah-complaint equities have no particular Shair'ah-based origins, while sukuk do. That cannot be said of the conventional counterparts. Said differently, conventional equities and debt both emanate from conventional financial structuring. Islamic equities generally do not emanate from Islamic financial structuring, while sukuk ostensibly do. Moreover, sukuk, from a strict Shari'ah-compliance standpoint, are not "fixed

income" securities (at least in theory). And most Shari'ah-compliant equities are quite simply conventional equities that have passed Islamic "screens" developed to transform conventional equities into Shari'ah-compliant ones for investment selection purposes. These screens, though not universal, are generally qualitative and quantitative in nature.

1.3 Research Questions. The following questions serve as the basic motivation for this paper:

1. Do these peculiarities surrounding the nature of Shari'ah-compliant equities and sukuk render their covariances and correlations markedly different from their conventional counterparts?

2. Are Islamic equities and sukuk supplements or complements for one another?

3. Does the 2007/2008 global financial crises help us understand the relationship between these two "Islamic" asset classes?

2.0 LITERATURE REVIEW

2.1 Theoretical Underpinnings. Fama and French (Fama, The Cross-Section of Expected Stock Returns, 1992) and their seminal work on risks and expected equity returns in capital markets served as a portal for a wellspring of research into variances and covariances. A torrent of research ensued testing and trying the capital asset pricing model (CAPM), see (Roll, 1994). Fama and French followed quickly with their seminal work on the effects of risks and returns as they relate to equity and bond markets (Fama, Common Risk Factors in the Returns of Stocks and Bonds, 1993).

Exemplary subsequent theoretical research into the dependencies between the equity and bond markets includes: (Fleming, 1998), a study that used Generalized Method of Moments (GMM) volatility modeling and found that common information leads to covariance in equity, bond and money markets; (Cappiello, 2006), a study that used MGARCH/DCC and found strong asymmetric volatility; (Fang, 2007) who used BEKK-MGARCH to decompose data and find that in domestic markets, the volatility transmission is unilateral from stock to bond markets, but international cross-market volatility is mixed, with strong evidence of volatility transmission among international stock markets, but weak evidence between international stock and bond markets (with the exception of significant bi-directional volatility transmissions between stock markets in Germany and the

U. K., and between Germany and the U. S); and (Dean, 2010), which using MGARCH (bivariate) found bond market volatility spills over into the equity market but the converse did not hold.

In the Islamic finance space, research into equity-debt covariance and correlations is sparse. (Kim H.-B. a., 2012) studied the covariance and correlation (sometimes referred to as volatility "spillover") between Islamic equities, sukuk and government bonds in Malaysia. Using a VAR-bivariate GARCH approach during the recent global financial crisis and a VECM-bivariate GARCH model thereafter, they found a unidirectional volatility spillover from the stock market to the bond market in Malaysia during that period, but no discernible evidence from the bond market to the equities market during the crisis period, but no market volatility during periods of stability. They found the bond market had a more dominant role in price discovery than the stock market.

(Kim H. B., 2013) regurgitated the above study for publication. It is the solitary work in the area that could be located and that study is limited to the Malaysian Islamic market and uses VAR-GARCH. Thus, it can be said, that at present, there is a veritable dearth of research into the area of Islamic equity-debt covariance and correlation. Research would seem to be important to Islamic financial managers, regulators, theorists and portfolio managers for asset pricing, risk measurement among risky assets and portfolio management. Obviously, other variables are pertinent to a thorough study of the relationship, but nevertheless little, if any ground work appears in the literature at present.

2.2 MGARCH--DCC. Subsequent conventional research has dovetailed off of the seminal research of Fama and French, using the advancing econometric techniques of GARCH and MGARCH. Exemplary research includes, but is not necessarily limited to: (Campbell, 1993), an early work that examined the offsetting effects on the unconditional correlation between stock and bond asset class returns. That study found the unconditional correlation between the asset classes was positive, albeit low, at approximately 0.2. (Brenner, 2009) used MGARCH/DCC finding that conditional means, volatilities, and co-movements among stock, Treasury, and corporate bond returns react asymmetrically to information content. Moreover, the Brenner et al. study found that correlations between daily returns on stock and bond indices on average were modestly positive but ranging anywhere from +0.60 to -0.60 over the last forty years; sometimes exhibiting sharp changes of 0.20 or more from month to month. "In negative correlation periods the markets are sometimes said to have "decoupled."

Many attempts have been made to explain this time variation, but no consensus exists, and the literatures on stock and bond pricing remain rather decoupled as well" (Baker, 2011).

2.3 Wavelet. Wavelet data analysis, a largely non-parametric econometric technique, allows researchers to decompose frequency data into various time scales (stretching or compressing it) and shifts that delay or advance data functions. It also allows researchers to examine high frequency data in its non-stationary form, i.e. data that contains long-term financial trend information, e.g. regime changes, bursts of variability, etc. (In, 2013). Thus, data sets can be examined and decomposed over a particular position, scale and time. Said differently, the related scaled coefficients for variables are substituted for the global sample coefficients. Thereby, cross-correlations may also be determined between two time series simultaneously and more or less isolate their relationships during scaled time periods (In, 2013, p. 29). This process reveals coherence, i.e. correlations at different time scales to measure how time series move together over a business cycle (In, 2013, p. 9).

3.0 EMPIRICAL METHODOLOGY AND DATA

3.1 Methodology. This paper applies two empirical methods to selected global indices for Shari'ah-compliant equities and fixed income securities, i.e. sukuk. Two timeframes are examined; one larger one that overlaps the other. MGARCH/DCC techniques are applied to the Thomson Reuters-Bond Pricing Agency Malaysia's All Sukuk Index (.TRBPAMALLI) and the Dow Jones Islamic Market World Index (DJIM or INDEXDJX:DJIM) for daily price returns from 31 December 2009 through 31 March 2014. Volatility and correlation for the indices were determined using Microfit 5. Longer term data for both indices were analyzed using Wavelet's Continuous Wavelet Transformation (CWT) techniques. Data from 1 January 2007 through 31 March 2014 was examined. The research method is bivariate, using MGARCH to derive covariance and correlation.

3.2 Data. The Dow Jones Islamic Market World Index (DJIM) is an Islamic equity benchmark index. Its stated purpose is to "provide a definitive standard for measuring stock market performance for Islamic investors on a global basis" (McGraw Hill Financial, 2014). DJIM consists of nearly 2,369 companies globally from 56 countries, covers over 10 economic sectors, with a market cap in 2014 of nearly 22.1 trillion dollars (McGraw Hill Financial, 2014). Daily

pricing data from 1 January 2007 through 31 March 2014 were selected for testing. There were 1,785 observations taken from Datastream.

The TR BPAM All Sukuk Index is a joint index launched by Thomson-Reuters and the Bond Pricing Agency of Malaysia. The index reflects both Malaysia's extensive experience in sukuk issuances, pricing and data collection and the Thomson-Reuters brand name, as well as its expertise in tracking global sukuk and bond issuances. The TR BPAMALLI index reflects Malaysia's dominance in the issuance of sukuk worldwide. At the end of 2011, of the $85 billion (USD) of global sukuk issuances, Malaysia accounted for $60.9 billion, or nearly 72% of the global total (Bacha, 2013, pp. 173, 194). The index itself contained on average over 566 sukuk issuances during the observation period with maximum issuances of 806 in latter period observation points. There were 1,785 observations taken from Bondstream.

Both data sets were synced as to date of pricing so that all observation points are on the exact date as and between both data sets. Both data sets from 31 January 2007 to 31 March 2014 were input into Microfit 5. However, a covariance breakdown occurred at the iteration phases of data analysis. Microfit could not iterate the datasets failed to converge (apparently not having a mean zero or are serially correlated). Both option 2 and 3 were applied, i.e. VAR and OLS regressions under MGARCH, but both yielded the same result. This problem is apparently documented in the literature. Excel was used to calculate both covariance and correlation between the datasets for the entire sample period.

(Jin, 2014) noted a similar issue related to structural breaks. That paper noted dynamic heterogeneous covariance breakdowns in multivariate GARCH (MGARCH). The researchers noted: "During periods of normal market activity, volatility dynamics are governed by an MGARCH specification. A covariance breakdown is any significant temporary deviation of the conditional covariance matrix from its implied MGARCH dynamics…Different breakdown periods will have different impacts on the conditional covariance matrix and are estimated from the data…When applying the model to daily stock market and bond market data, we identify a number of different covariance breakdowns."

After discussion of the iteration failure with tutorial staff, it was surmised that the structural breaks relating the 2007-2008 financial crisis may have prevented iteration convergence. Accordingly, the datasets for the MGARCH covariance

and correlation examination was reduced to 1,043 observations from 1 January 2010 to 31 March 2014.

3.3 M-GARCH --DCC. Estimation results for the MGARCH-DCC results with respect to the test period of 1 January 2010 to 31 March 2014 as shown in Table 1 summarizes the maximum likelihood estimates (LME) of λ_1 and λ_2 for the 2 asset class indices returns, and δ_1 and δ_2, comparing the bivariate normal distribution with bivariate *t*-distribution. Index specific estimates of the volatility decay parameters are all highly significant.

The maximized log-likelihood value for the *t*-distribution (9965.1) was larger than the normal distribution assumption (9823.4). The estimated degree of freedom for the *t*-distribution (5.2422) is well below 30 and is acceptable for what one would expect for a bivariate normal distribution. This suggests that the *t*-distribution may be more appropriate in capturing the fat-tailed nature of the distribution of index returns (Pesaran, 2009).

Table 1-Maximum Likelihood Estimates

Parameter	Estimate
Lamda$_1$-DSUKUK	.76641
Lamda$_1$-DEQUITY	.89164
Lamda$_2$-DSUKUK	.14202
Lamda$_2$-DEQUITY	.089166
Delta$_1$	.99792
Delta$_2$	.0043771
Degrees of freedom (df)	5.2422
Maximum Log-Likelihood	9965.1

Both asset classes show presence of significant volatility. However, equities, whose lambdas approach unity (.9808) are more volatile as compared to sukuk (.9084). Imminent decay would be expected as the former, while further volatility might occur with respect to the latter before decay begins.

The bivariate unconditional specifications again indicate that Shari'ah-compliant equities (.0096787) are expected to be more volatile than sukuk (0.0006168).

Correlation is negative and weak as to these asset classes as seen in the off-diagonal value of -.0077678.

Figure 1 depicts the conditional covariance between the Shari'ah-compliant and sukuk asset classes in the global Islamic capital market. Figure 1 shows unequivocally the significant difference between the conditional volatilities between the two asset classes, i.e. Shari'ah-compliant equities and sukuk. The volatility is significantly higher for the equity class. This finding is confirmed by the MLE tests in Table 1. The volatility decay factors support the finding that sukuk volatility can be expected to decay or decline, while further volatility increase may be expected for the Shari'ah-compliant equities.

Figure 1

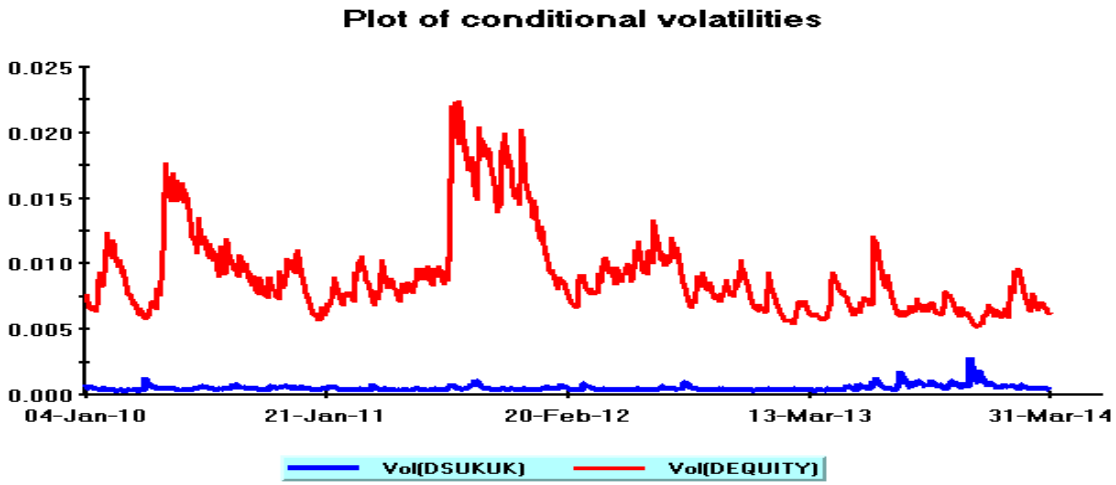
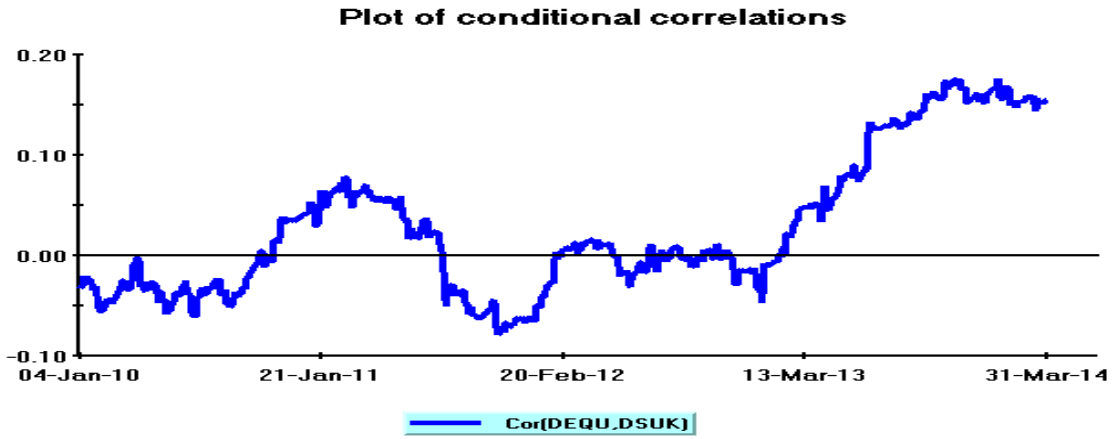


Figure 2 depicts the correlation between the Islamic asset classes. The range of correlations between the Shari'ah-compliant equities and sukuk securities is noteworthy, i.e. from a low of roughly -.08 to +.20. That finding is consistent with previous studies of the equity-debt correlations in the conventional capital markets.

Figure 2



3.4 Wavelet. As indicated, Wavelet was used to examine the long-term trend of the performance of the two asset classes. Table 2 shows the descriptive statistics for the 10-year plus performance period of the two Islamic asset classes from 1 January 2007 through 31 March 2014.

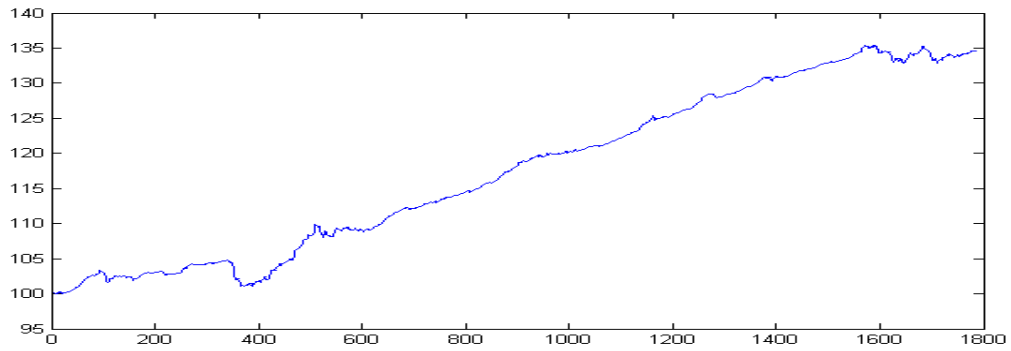
Table 2-Descriptive Statistics

Statistic	TR BPA	DJIMI
Observations	1785	1785
Mean	1.0002370	0.0002840
Standard deviation	0.0055022	0.0127652
Minimum	-0.0227819	-0.0825996
Maximum	0.0949329	0.1115631
Skewness	7.5065111	-0.2253495
Kurtosis	98.1695787	7.9073381
Covariance	0.0000017	
Correlation	0.0244579	

As indicated by the descriptive statistics, sukuk returns are positively and highly skewed, while Shari'ah-compliant equities are negative and approximately

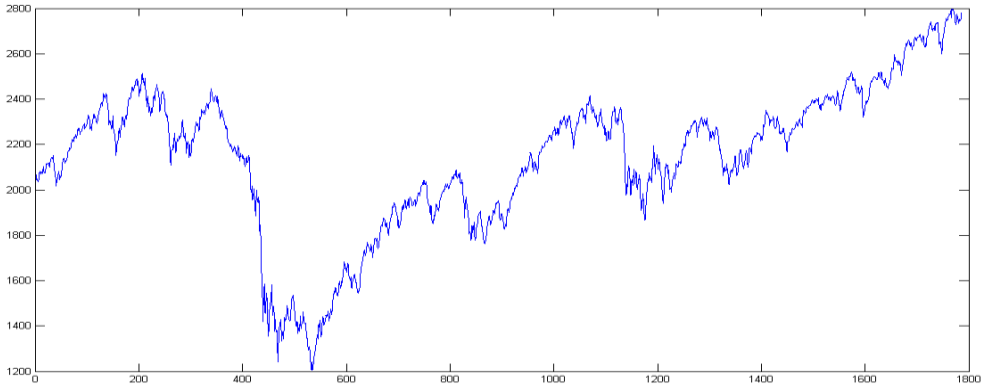
symmetric. The high kurtosis for sukuk indicates sharp, long, fat tails, symptomatic of leptokurtic financial behavior and the leverage effect. Over the long-term, there appears to be very little covariance between the two asset classes and relatively mild positive correlation. Figures 3 and 4 depict the historical trends for global sukuk and Shari'ah-compliant equities, scaled by Wavelet, to a daily timeframe. Thus, the horizontal axes are in days vis-à-vis years. It can be noted that the approximate timing of the impact of the 2007-2008 global financial crisis was approximately 275 days from the beginning of 2007, i.e. October of that year. That downward financial slide is reflected in the trend graphs for both asset classes, as well as the more pronounced extension of the crisis well past the 400 day plus mark.

Figure 3-Long-term Sukuk Trend



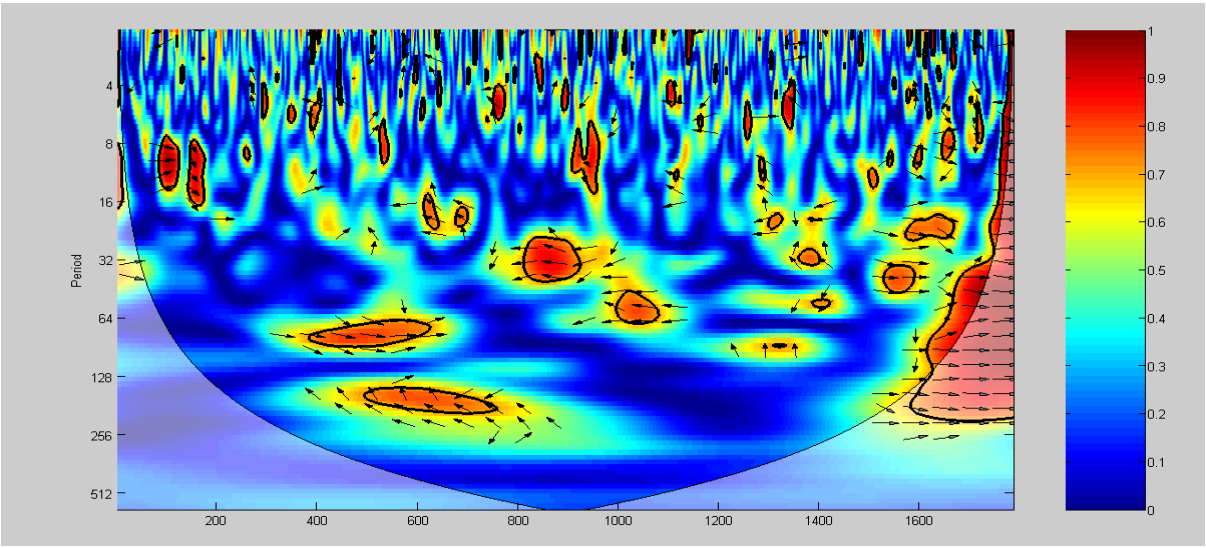
DJIMI by contrast is shown in Figure 4. The effects of the financial crisis are more pronounced than those on the sukuk and deeper, showing the greater volatility associated with the Shari'ah-compliant equities. The offset of the crisis can be seen affecting them earlier culminating with a deeper and longer decline in pricing.

Figure 4-Long-term Shari'ah-compliant Equities Trend



Finally, Wavelet allows researchers to examine the coherence by scaling correlations, which can be seen in Figure 5. It can be seen from Figure 5 that other than in a few relatively isolated timeframes, there is only mild coherence between the two asset classes, i.e. .7 to .8 correlations during the 400 to 800 day timeframe and approximately the 64 to 200 day horizons respectively. For the remainder of the time and horizons (with the exception of the most recent data), there is very little coherence. Recent pricing, however, does show a markedly larger level of coherence and horizon duration. This appears to confirm the results in Figure 2 above showing greater conditional correlation under DCC.

Figure 5-Wavelet Coherency Power Spectrum



Note: The horizontal axis is in days, while the vertical (on the left) axis are scaled investment horizon periods. The color scale of coherence is on the right wherein bluish colors indicate less coherence, while redish colors indicate more coherence; scaled from 0 to 1.

4.0 RESEARCH LIMITATIONS AND CONCLUSIONS

4.1 Research Limitations. As noted herein above, the use of MGARCH and DCC methods were limited with respect to the entire study period, i.e. from 1 January 2004 to 31 March 2014. Instead, iteration in Step 1 of the DCC procedure was not possible until 1 January 2010 to the end of the study period, 31 March 2014. This, of course, prevented the use of DCC for purposes to examining variable behavior before, during and after the financial crisis.

4.2 Conclusions. This research posited three questions:

1. Do these peculiarities surrounding the nature of Shari'ah-compliant equities and sukuk render their covariances and correlations markedly different from their conventional counterparts? Since this study did not include a portion that empirically tested the conventional counterparts to the Islamic market equities and sukuk (if it is even fair to assume that sukuk and bond data might be sufficiently similar to draw empirical conclusions), this question can only be answered in light of existing studies.

As noted in the Literature Review section of this paper, (Campbell, 1993) found the unconditional correlation between the conventional equities and bond asset classes was positive, albeit low, at approximately 0.2. Figure 2 of this study indicates that the two markets, i.e. conventional and Islamic, demonstrate a similar conditional correlation during a period of non-crisis. The Brenner et al. study found that correlations between daily returns on conventional stock and bond indices were modestly positive, on average, but somewhat volatile, ranging anywhere from +0.60 to -0.60 over the last forty years; sometimes exhibiting sharp changes of 0.20 or more from month to month. While this study's data only goes back 10 plus years and the range in that timeframe does not reflect correlations of .6 in either direction, there is indications of fluctuations of somewhere between -.08 and .2. As noted by (Baker, 2011): "In negative correlation periods the markets are sometimes said to have "decoupled." The Wavelet coherence data from Figure 5 suggests that decoupling may be more persistent than not.

2. Are Islamic equities and sukuk supplements or complements for one another? This study's findings suggest that the volatilities of the two asset classes are significantly different and that sukuk are less volatile than Shari'ah-compliant equities. Because there is persistent high correlation during non-crisis periods, and mild negative correlation during periods of crisis, the results of this study suggests that the two asset classes may, from a portfolio management perspective,

are normally complementary and are supplementary only during times of crisis. Figure 2, the conditional correlations between the two asset classes, clearly shows such a pattern.

3. Does the recent 2007/2008 global financial crises help us understand the relationship between these two "Islamic" asset classes? Figures 3 and 4 suggest that there is a markedly different level of volatility between the two asset classes. Table 1 estimations support this conclusion as well.

REFERENCES

Anderson, T. G. (2007). Practical Volatilities and Correlation Modeling for Financial Market Risk Management. In T. G. Anderson, *The Risks of Financial Institutions:*513-548. Chicago: University of Chicago Press.

Bacha, O. (2013). *Islamic Capital Markets: a Comparative Approach.* Singapore: John Wiley & Sons.

Baker, M. (2011). *Global, Local, and Contagious Investor Sentiment.* Cambridge: Harvard Business School.

Beck, T. (2002). *Stock Markets, Banks and Growth: Panel Evidence.* Cambridge, MA: National Bureau of Economic Research.

Bodie, Z., & Kane, A. (2011). *Investments and Portfolio Management.* New York: McGraw Hill.

Brenner, M. P. (2009). On the Volatility and Comovement of U.S. Financial Markets Around Macroeconomic News Announcements. *Journal of Financial and Quantitative Analysis* , 44(6), 1265-1289.

Campbell, J. (1993). What moves the stock and bond markets? a Variance Decomposition for Long Term Asset Returns. *Journal of Finance* , 48(1), 3-37.

Cappiello, L. (2006). Asymmetric Dynamics in the Correlations of Global Equity and Bond Returns. *Journal of Financial Econometrics* , 4(4), 537-572.

Chulia, H. a. (2008). The Economic Value of Volatility Transmission between the Stock and Bond Markets. *Journal of Futures Markets* , 28(11), 1066-1094.

De Goeij, P. (2002). *Modeling the Conditional Covariance Between Stock and Bond Returns: a Multivariate GARCH Approach.* Rottendam: Erasmus Research Institute of Management.

Dean, W. G. (2010). Asymmetry in return and volatility spillover between equity and bond markets in Australia. *Pacific Basin Finance Journal* , 18(3), 272-289.

Demirguc-Kunt, A. a. (1999). *Bank-based and Market-Based Financial Systems.* Washington, DC: World Bank Policy Research, Working Paper 2143.

Engle, R. (2002). Dynamic Conditional Correlation: a Simple Case of Generalized Autoregressive Conditional Heteroskedasticity Models. *Journal of Business and Economic Statistics* , 20(3), 339-350.

Fama, E. F. (1993). Common Risk Factors in the Returns of Stocks and Bonds. *Journal of Financial Economics* , 33(1), 3-56.

Fama, E. F. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance* , 47(2), 427-466.

Fang, V. L. (2007). Volatility Linkages and Spillovers in Stock and Bond Markets: Some International Evidence. *Journal of International Finance and Economics* , 7(1), 1-10.

Fleming, J. (1998). Information and Volatility Linkages in the Stock, Bond and Money Markets. *Journal of Financial Economics* , 49(1), 111-137.

In, F. (2013). *An Introduction to Wavelet Theory in Finance.* Singapore: World Scientific Publishing.

Levine, R. (1997). Financial Development and Economic Growth: Views and Agenda. *Journal of Economic Literature* , 35(2), 688-726.

Moran, D. E. (2011). The Role of the Dow Jones Islamic Market Index in Islamic Finance. *Third Harvard University Forum on Islamic Finance*, 257-58. Cambridge: Harvard University.

Patrick, H. (1966). Financial Development and Economic Growth in Underdeveloped Countries. *Economic Development and Cultural Change* , 14(2), 174-189.

Pesaran, B. (2009). *Time Series Econometrics using Microfit 5.0.* Oxford: Oxford University Press.

Roll, R. and Ross, S. (1994). On the Cross-Sectional Relation between Expected Returns and Betas. *The Journal of Finance* , 49(1), 101-121.